

# Restructuring of smallholders' farming and implications for research: Some insight from China

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## Introduction

My presentation is about the implications for research when smallholders' farming is engaged into restructuring. I will give some illustration of the extent of variation of farm size and cotton area per farm in the world. Size could matter in the performance of cotton growing, but this could be truer within a country than between countries as it is the case in China. This is the rationale of the policy set in China towards a larger size farming that I will introduce briefly before outlining the implications for cotton research.

## Size varies and matters in performance

Across the world, farm size varies a lot mainly under the influence of corporate farming as opposed to family farming. The two farming types could co-exist in the same country. Among the estimated number of 570 millions farms in the world, family farming accounts for the biggest share of more than 85%.

Would family farming always prevail if alternative farming type is better performing? Is better performance actually the case? A glance at the Brazilian case is informative. Brazil is known for the big size of its farms, mostly corporate farms, family farming is much more important in number of farms but not in area. Farms over 1000 acres account for more than 40% of all farms. In the Central West region of Brazil, family farming accounts the least but the share of this region in the national agricultural production is the highest. This is an observation that may influence policy maker to enhance farming of bigger size.

The size of cotton areas in farms varies also a lot between country but globally, countries of smallholding production still account like in Asia such as China.

## Farming restructuring in China

The case China illustrates that within a country, production tends to shift towards regions of bigger farms, where yield is higher and where cultivation techniques are specific. In China, the restructuring of farming is not guided by the issue of yield as its level is already commendable. It is guided by income which depends on farm size, and furthermore by the increasing gap with the income in cities. Restructuring occurs as the abandon of farming by some farmers could help others to get bigger.

Farming has become little attractive to youngsters, as indicated by the little involvement of youngsters in farming we found in our surveys. Only 7% and 9% of farmers' sons and daughters, respectively, are taking part to field works.

In China, the future of farming has become a concern publicly mentioned and the evolution of the farming structure asks for political support. The actual integration of the restructuring of farms into agricultural policy dates back to around fifteen years. This integration result from the belief that small family farms suffer from the lack of economies of scale and connection to market, hence revealing an envisioned model of mechanized farming connected to market.

The goal of the policy set up is an agriculture which is productive, efficient and environmentally friendly. Science and technology innovation are part of the measures contemplated to achieve the goal. Objectives claimed are ambitious, with 70% of mechanized farms and 40% of land managed by moderately large scale farms. Important funding was made available to achieve the targeted mechanization rate.

The policy implemented is two-fold, one is to promote bigger size farms, another is to enhance cooperatives and corporate farms. A new generation of specialized family farmers is envisioned, with people totally dedicated to farming, who are educated and trained to command technology and management. Specialized family farmers are distinct from what are called professional farmers in China and which are closer to farming corporations, by the farm size and by the nature of labour involved. I have already presented the Chinese policy to promote specialized family farming at the plenary session on ICAC in 2013. Security in leasing land and subsidy for mechanization are two pillars of the policy.

Professional farmers should be more accurately called corporate farming. Their operation lie on science-based techniques like hydroponic production or the exploitation of the Chinese type of greenhouse where plants are drip irrigated and beehives could be installed when needed, like in strawberry production.

Cooperatives are promoted more recently by encouraging farmers to hand over the land use right although the process is less recent. The first generation of cooperatives, dates back to the late 1980s, was privatized ten years later. The number of rural cooperatives is impressive according to a nationwide survey in 2009. More than 200 000 cooperatives were found involving 23.8 millions of households. A report in 2012 mentions almost 700 000 cooperatives. Cooperatives are of diverse types, but most are called farmers' specialized cooperatives operating on land handed over by their member-farmers and managing production and marketing, sometimes with product branding. Provision of technical information and inputs is frequent but not systematic, while credit supply is rare. A so-called cooperative I visited in 2017 operated on 800 ha and dealt with productions of beans and tree shrubs. Many activities were contemplated going from production to processing till recreational services.

How the small size family farming would evolve as the consequences of the policy engaged in China remains to be further documented. A survey we have implemented in Hebei province, northern China, provides indications that small size family is not going to disappear in the short run. Less than 50% of farmers plan to get further involved in off-farm activities. Only a minority of 24% plans to abandon farming while expecting policy measures and market orientation to make farming more profitable.

## Implications for research with persisting small size farming within farming restructuring

In China, small size farming is not going to disappear in the short run, implying that research has to address two types of farms varying by size. There is no large mono-cropping in sight, not that one observed in countries like Australia, Brazil, Argentina or USA. Implications for research can be contemplated in various domains that I will go through quickly.

Research has to help adapt mechanization. Such a process is already engaged, leading to various models of tools or machines for a same operation (like seeders), some commendable and inspiring machineries (like three-wheel multi-operation tractor or do-it-yourself devices set on motorbikes), but the mechanization of harvest remains the challenge yet to overcome.

Small and medium sizes of farming allow greater flexibility in considering new cropping patterns. I focus mainly on the implications for research resulting from new cropping patterns. Research in China is already well engaged in relay and inter-cropping (cotton with various crops such as wheat, onion, watermelon...), which is in addition assumed to be in line with the agro-ecological approach of farming with better environmental and social impacts.

Cultivation practices have to be adapted in new cropping pattern so as to optimize the interaction, namely reduce competition and increase synergy between crops. This should be achieved through adjusting sowing dates, plant densities and growth regulation of cotton plants, as well as weed control. Allelopathy is the area of research which is worth being much more addressed.

Optimized fertilizing might be kind of allelopathic effect in new cropping patterns. Evidence is found for patterns involving annual crops or trees. In China, the cotton-peanut intercropping being currently launched could be considered as an exploitation of allelopathic effect, although it remains to be properly evaluated. In Zambia, the legume tree *Faidherbia albida* is alley cropped with maize or cotton. This tree loses its leaves in rainy season, hence not shading crops, and showing them in dry season. Its deep root system helps to pump up nutrients and make them available to crops, up to 100 kg/ha of Nitrogen, not mentioning other nutrients

New cropping patterns also ask for adapted varieties. Research is undergone in China through shorter cycle so that labour-intensive transplanting could be replaced by direct sowing. Some research works have already ascertain genetic diversity with regard to the photosynthetic performance of non-leaf organs.

As long as farming landscape is composed of very heterogeneous canopies of plants, there is no reason to follow crop protection techniques or recommendations made for farming landscape of very large size farming like in the US or in Brazil. But unconsciously, this wisdom is overlooked sometimes. The reality of heterogeneous canopies of plants is not sufficiently integrated into the research on cotton pest control. The technique of push-pull is a rare example of integrating the variable host-pest interactions. More needs to be done. The related effects ask for being assessed, and it is not easy.

New cropping patterns should lead to revisit crop protection research as pest infestation rate might differ as opposed to single crop pattern. Protection program will have to be adjusted to pest infestation rate and new rules might emerge. Maybe chemical sprays might become less required. When multi-cropping involves food crops, as long as chemical sprays are implemented, the concern of preserving food safety must be considered.

One way of reducing the use of chemical is to take advantages of some morphological traits which remain seldom exploited except for okra leaf. Other traits are yet to be exploited (frego bracts, high gossypol content, red leaf...). It will not be that much easy because each trait might help control one specific pest while it might attract other pests. How the phenomenon of attraction or repulsion works in multi-crop patterns is yet to be studied.

My last reflection on the implication for research goes beyond the restrictive focus on new cropping patterns. R&D must be adapted, because the modalities to acquire machineries and to provide mechanical services have to be adapted to local contexts of small-medium size farming. Information delivery is key to share the adapted research outputs. Farmers in small size family farming are generally poor, but they are almost all equipped with mobile phones, thanks to manufacturers from China. Reaching a big mass of people has become easier and effective as evidence is provided by India for instance

In conclusion, in China, and in Asia in general, small size of family farming will persist for a while although medium size farming has emerged and will keep on growing. So, research must take both small and medium size farming into account and be less influenced by research for large size farming. There is a lot to do, when considering only the potential prospects of multi-cropping patterns. Research on allelopathy would be exciting to take advantage of favorable interactions between crops. The assessment of the techniques in multi-cropping patterns will be demanding albeit exciting to attract youngsters. The demanding characteristic asks for more exchanges between scientists through meetings.